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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/647,534	08/26/2003	Anthony Dip	240579US6YA	2715

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EXAMINER	
MALDONADO, JULIO J	
ART UNIT	PAPER NUMBER
2823	

SHORTENED STATUTORY PERIOD OF RESPONSE	NOTIFICATION DATE	DELIVERY MODE
3 MONTHS	04/25/2007	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Notice of this Office communication was sent electronically on the above-indicated "Notification Date" and has a shortened statutory period for reply of 3 MONTHS from 04/25/2007.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/647,534	DIP ET AL.	
	Examiner	Art Unit	
	Julio J. Maldonado	2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 October 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2,4-8,10-12 and 17-24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1, 2, 4-8, 10-12 and 17-24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. The rejection as set forth in the office action mailed on 10/05/2006 is withdrawn in view of the prior art of record.

2. Claims 1, 2, 4-8, 10-12 and 17-24 are pending in the application.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1, 2, 5-8, 10, 11 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thakur (U.S. 6,589,877 B1).

In reference to claims 1, 7 and 24, Thakur (Fig.1) teaches a method of cleaning a substrate including the steps of providing a semiconductor substrate (column 1, lines 35 – 38); performing an oxide growth (Fig.1, 22D) and vapor cleaning process (Fig.1, 22F) including growing an oxide layer over a substrate to consume defects in a surface region of the substrate, wherein said oxide is formed by rapid thermal oxidation and has a thickness of at least generally 10 angstroms (column 4, lines 31 – 34), and in a preferred embodiment of the invention, the oxide has a thickness 30 to 40 angstroms (column 4, lines 45 – 50); and performing a vapor cleaning step (Fig.1, 22F) on the substrate, etching away the grown oxide layer to remove at least some of said consumed defects from the substrate and reveal a subsurface of said substrate (column 4, line 66 – column 5, line 17), wherein any number of oxidation steps and cleaning

steps are performed as needed (column 8, lines 1 – 20). Therefore, Thakur is open to form a second oxide layer after etching the first oxide and repeatedly growing additional oxide layers to consume additional defects.

Thakur fails to expressly teach a preferred embodiment having a thickness of generally 10 Angstroms. Although not taught as a preferred embodiment, Thakur teaches this embodiment nonetheless and disclosed examples and preferred embodiments do not constitute a teaching away from a broader disclosure or nonpreferred embodiments In re Susi, 440 F.2d 442, 169 USPQ 423 (CCPA 1971). Furthermore, "[t]he prior art's mere disclosure of more than one alternative does not constitute a teaching away from any of these alternatives because such disclosure does not criticize, discredit, or otherwise discourage the solution claimed...." In re Fulton, 391 F.3d 1195, 1201, 73 USPQ2d 1141, 1146 (Fed. Cir. 2004). See MPEP 2123, I and II. To further clarify, a prior art opinion that a claimed invention is not preferred for a particular limited purpose, does not preclude utility of the invention for that or another purpose, or even preferability of the invention for another purpose.

Still, Thakur fails to expressly disclose wherein the thickness of the oxide layer is less than 15 Angstroms. However, in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. MPEP 2144.05. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the thickness disclosed in Thakur to arrive at the claimed invention.

Furtherstill, Thakur fails to expressly disclose monitoring said surface region of the substrate and repeatedly growing an additional ultra-thin oxide layer to consume additional defects and etching the additional oxide layer to remove the consumed additional defects based on said monitoring of said surface region. However, it is inherent that there has to be an inspection step to detect level of contaminants on a substrate in order to continue or stopping said growing and etching steps until all of the contaminant or substrate surface damage has been removed.

In reference to claim 2, Thakur fails to expressly disclose wherein the thickness of the oxide layer is between approximately 5 Angstroms and 10 Angstroms. However, in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. MPEP 2144.05. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the thickness disclosed in Thakur to arrive at the claimed invention.

In reference to claims 5 and 6, Thakur teaches wherein the substrate comprises silicon (column 1, lines 35 – 38).

In reference to claims 8, 10 and 11, Thakur teaches wherein said vapor cleaning process is a dry vapor etching process comprising an HF vapor clean (Thakur, column 3, lines 54 – 58).

5. Claims 4 and 17-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thakur ('877) as applied to claims 1, 2, 5-8, 10, 11 and 24 above, and further in view of Park et al. (A study on modified silicon surface after CHF_3C/C_2F_6 reactive ion etching, hereinafter Park).

In reference to claim 4, Thakur substantially teach all aspects of the invention but fail to disclose wherein said monitoring comprises using high-resolution transmission electron microscopy (HRTEM) data. However, Park teaches a monitoring method to detect level of contaminants on a substrate, wherein said monitoring includes HRTEM (Abstract). It would have been within the scope of one of ordinary skill in the art to combine the teachings of Thakur and Park to enable monitoring the reduction of contaminants in the substrate of Thakur according to the teachings of Park because one of ordinary skill in the art at the tie the invention was made would have been motivated to look to alternative suitable methods of monitoring the substrate of Thakur and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

In reference to claims 17-20, the combined teachings of Thakur and Park inherently teach wherein said monitoring includes imaging the surface of the substrate after removal of one of said ultra-thin oxide layers using HRTEM data. Further support can be found in Wolf (Semiconductor Processing for the VLSI Era, Volume 1: Process technology, pages 586, 587 and 597-599) and Herbots et al., U.S. 6,613,677 (Figs.6A-6B and column 19, lines 15 – 40) and furthermore, since the same monitoring is used, the same data results would be obtained.

6. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Thakur ('877) as applied to claims 1, 2, 5-8, 10, 11 and 24 above, and further in view of Wolf et al. (Silicon Processing for the VLSI Era, Volume 1: Process Technology, hereinafter Wolf).

Thakur substantially teaches all aspects of the invention but fails to further disclose processing a plurality of substrate including said substrate, wherein each of said growing steps of said growing steps and each of said etching steps is performed on each of said plurality of substrates. However, Wolf teaches conventional methods of performing oxidation (Wolf, pages 230 – 234) and etching (Wolf, pages 568 – 574) steps on a substrate, wherein said oxidation and etching steps are performed on multiple substrates. It would have been within the scope of one of ordinary skill in the art to combine the teachings of Thakur and Wolf to enable the multiple oxidation and etching steps of Thakur according to the teachings of Wolf because one of ordinary skill in the art at the time the invention was made would have been motivated to look to alternative suitable methods of performing the disclosed multiple oxidation and etching steps of Thakur and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

7. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Thakur ('877) as applied to claims 1, 2, 5-8, 10, 11 and 24 above, and further in view of Maydan et al. (U.S. 2004/0121605 A1, hereinafter Maydan).

Thakur substantially teaches all aspects of the invention but fails to disclose wherein the semiconductor substrate comprises silicon germanium. However, Maydan teaches a method of cleaning substrates including forming an oxide layer on a surface of a substrate, followed by removing said oxide, wherein said substrate comprises a material selected from the group including silicon and silicon germanium (Maydan, [0047]).

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Thakur and Maydan to enable using a substrate in Thakur according to the teachings of Maydan et al. because one of ordinary skill in the art at the time the invention was made would have been motivated to look to alternative suitable methods of using the disclosed substrate in Thakur and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

8. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Thakur (877 B1) and Maydan ('605 A1) as applied to claims 1, 2, 5-8, 10, 11, 21 and 24 above, and further in view of Callegari et al. (U.S. 6,573,197 B2, hereinafter Callegari).

The combined teachings of Thakur and Maydan teach forming said oxide layer using an RTO process (Thakur, column 2, line 39 – column 5, line 58 and column 8, lines 1 – 20). The combination of Thakur, and Maydan fail to disclose growing said oxide layer using a plasma assisted process. However, Callegari in a related method to form oxide layers on a silicon or silicon germanium substrate, teaches forming oxide layers of 10Å or less using, for example, RTO or direct plasma oxidation process (Callegari, column 3, lines 60 – 65 and column 4, lines 23 – 34). It would have been within the scope of one of ordinary skill in the art to combine the teachings of Thakur and Maydan with Callegari to enable the oxidation step of Thakur and Maydan to be performed according to the teachings of Callegari because one of ordinary skill in the art at the time the invention was made would have been motivated to look to alternative suitable methods of performing the disclosed oxidation step of Thakur and Maydan and

art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

9. Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Thakur ('877), Maydan ('605 A1) and Callegari ('197) as applied to claims 1, 2, 5-8, 10, 11, 21, 22 and 24 above, and further in view of Wolf.

The combined teachings of Thakur, Maydan and Callegari teach wherein said growing of said oxide layer comprises a plasma assisted process (Callegari, column 3, lines 60 – 65 and column 4, lines 23 – 34), but fail to disclose wherein said etching comprises a plasma assisted process. However, Wolf teaches conventional etching steps including using a plasma process to etch oxide layers (Wolf, page 544, second paragraph). It would have been within the scope of one of ordinary skill in the art to combine the teachings of Thakur, Maydan and Callegari with Wolf to enable the etching step of Thakur, Maydan and Callegari to be performed according to the teachings of Wolf because one of ordinary skill in the art at the time the invention was made would have been motivated to look to alternative suitable methods of performing the disclosed etching step of Thakur, Maydan and Callegari and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

Response to Arguments

10. Applicant's arguments filed 01/24/2007 have been fully considered but they are not persuasive.

Applicants argue, "...there is no indication in Thakur that the total oxide thickness to be grown and removed is less than 15Å as clearly stated in claim 1...". In response

to this argument, as stated hereinabove, Thakur teaches wherein the grown oxide is formed by rapid thermal oxidation and has a thickness of at least generally 10 angstroms (column 4, lines 31 – 34), and in a preferred embodiment of the invention, the oxide has a thickness 30 to 40 angstroms (column 4, lines 45 – 50). Thakur also teaches performing a vapor cleaning step (Fig.1, 22F) on the substrate, etching away the grown oxide layer to remove at least some of said consumed defects from the substrate and reveal a subsurface of said substrate (column 4, line 66 – column 5, line 17), wherein any number of oxidation steps and cleaning steps are performed as needed (column 8, lines 1 – 20). Although Thakur does not teach growing an oxide layer having a thickness of 10Å as a preferred embodiment, Thakur teaches this embodiment nonetheless and disclosed examples and preferred embodiments do not constitute a teaching away from a broader disclosure or nonpreferred embodiments In re Susi, 440 F.2d 442, 169 USPQ 423 (CCPA 1971). Furthermore, "[t]he prior art's mere disclosure of more than one alternative does not constitute a teaching away from any of these alternatives because such disclosure does not criticize, discredit, or otherwise discourage the solution claimed...." In re Fulton, 391 F.3d 1195, 1201, 73 USPQ2d 1141, 1146 (Fed. Cir. 2004). See MPEP 2123, I and II. To further clarify, a prior art opinion that a claimed invention is not preferred for a particular limited purpose, does not preclude utility of the invention for that or another purpose, or even preferability of the invention for another purpose. Therefore, Thakur teaches on the argued limitation.

Applicants further argue, "...One does not have to monitor the surface region of a substrate to obtain historical data on a process step. For example, the historical data may be based on the electrical characteristics of an end device. Moreover, the Office Action analyzes the monitoring step completely out of context. Applicants' Claim 1 does not recite just any monitoring of any substrate to obtain data. Rather the claim recites monitoring a surface region of the substrate that the ultra thin oxide is repeatedly grown on and removed from to remove defects. The monitoring determines the number of repeated growth/removal steps. This particular monitoring does not necessarily result from the cited references and is therefore not inherent. Thus, Applicants' monitoring step provides an additional basis for patentability of Claim 1 over the cited references...". In response to this argument, Thakur teaches performing any number of oxidation steps and cleaning steps are performed as needed (Thakur, column 8, lines 1 – 20). That is inherently a disclosure of determining the level of contaminants at the surface, or monitoring the surface, at least between steps, to determine if additional oxidation steps are needed. Performing electrical testing of the surface is encompassed by "monitoring the surface" because such a test would keep track of the surface quality at each step. It is noted that one time monitoring is intended to be encompassed by the term [instant 0054]. Therefor the instant claims encompass at least the process of obtaining the historical data used to design process regimen for future wafers.

Conclusion

11. Applicants are encouraged, where appropriate, to check Patent Application Information Retrieval (PAIR) (http://portal.uspto.gov/external/portal/pair) which provides applicants direct secure access to their own patent application status information, as well as to general patent information publicly available.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to examiner Julio J. Maldonado whose telephone number is (571) 272-1864. The examiner can normally be reached on Monday through Friday.

13. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith, can be reached on (571) 272-1907. The fax number for this group is 571-273-8300. Updates can be found at http://www.uspto.gov/web/info/2800.htm.

Julio J. Maldonado
Patent Examiner
Art Unit 2823

Julio J. Maldonado
April 5, 2007

George Fourson
Primary Examiner